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應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

https://iapme.um.edu.mo/

ISSUE 12

11 December 2024

✧ Content

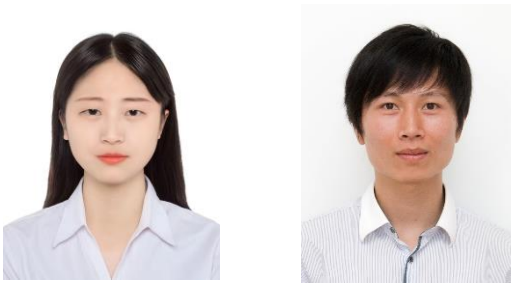
❖ Publications (IF≥8; *corresponding author)

1. **Fengming Hu**, Qian Zhou, Ruolin Liu, Yanfei Zhu, Yuanzhe Liang, Dan Fang, Bing Ji, Zhiming Chen,* Jianyi Luo,* and **Bingpu Zhou***. Top-down Architecture of Magnetized Micro-cilia and Conductive Micro-domes as Full Bionic Electronic Skin for De-coupled Multidimensional Tactile Perception. *Materials Horizons* (2024). DOI:10.1039/d4mh01217h. [2023 IF=12.2]

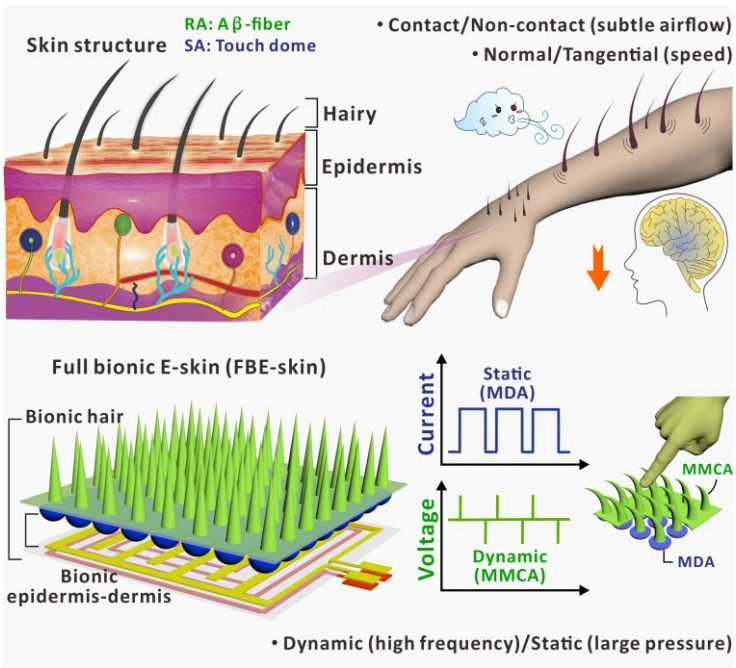
❖ Research Stories

UM and Wuyi University research teams successfully develop full bionic electronic skin to de-couple multidimensional tactile stimuli

- Based on the concept of human skin surface, magnetized micro-cilia array (MMCA), micro-dome array (MDA), and flexible electrodes are manufactured to replicate the biological hair layer, epidermis–dermis, and subcutaneous RA/SA receptors.
- The integration of MMCA and MDA functions in a complementary and cooperative behavior to the external mechanical stimuli with more detailed information, including the moment of touch/release, mechanical duration, and the sliding speed/direction. Integrated with three-dimensional (3D) MMCA, FBE-skin is capable to distinguish multi-dimensional mechanical signals in dynamic/static, normal/tangential, and contact/non-contact formats, as the human skin.
- Upon this, the single FBE-skin device was arrayed as a visualization system to digitize human sensations, showcasing the potentials for sliding speed detection, providing warnings for close-range stimuli before direct skin contact, and subtle airflow perception, etc.



(from left) Ms. Fengming Hu and Prof. Bingpu Zhou



Schematic diagram of full bionic electronic skin (FBE-skin) to de-couple multidimensional tactile stimuli.

Fengming Hu, Qian Zhou, Ruolin Liu, Yanfei Zhu, Yuanzhe Liang, Dan Fang, Bing Ji, Zhiming Chen,* Jianyi Luo,* and **Bingpu Zhou***. Top-down Architecture of Magnetized Micro-cilia and Conductive Micro-domes as Full Bionic Electronic Skin for De-coupled Multidimensional Tactile Perception. *Materials Horizons* (2024). DOI:10.1039/d4mh01217h. [2023 IF=12.2]

Prof. Bingpu Zhou, Prof. Jianyi Luo and Dr. Zhiming Chen are the corresponding authors of this study. The first authors is Fengming Hu, a Ph.D. student in IAPME. This project was funded by the Science and Technology Development Fund, Macau SAR (006/2022/ALC and 0057/2023/RIB2), the Guangdong Science and Technology Department (2022A0505030024), and Innovation and Strong School Engineering Fund of Guangdong Province (2020ZDZX2022, and 2021ZDJS094).

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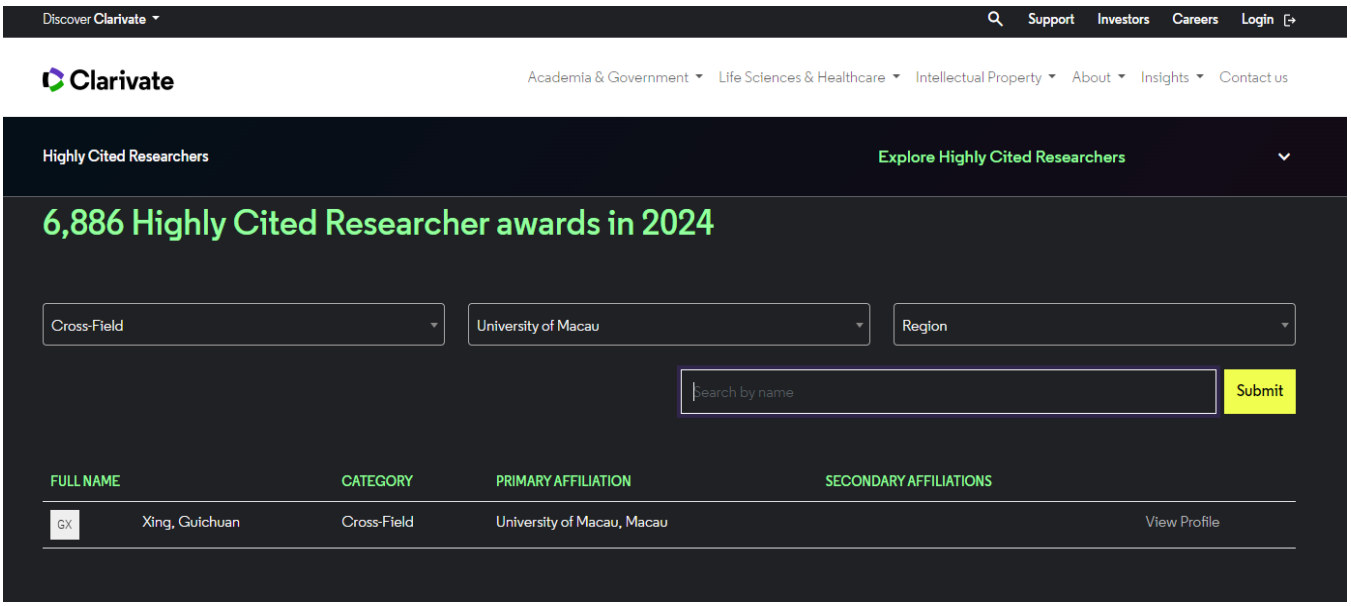
❖ IAPME Professor Named to the 2024 List of Highly Cited Researchers

In November, Clarivate announced its 2024 list of Highly Cited Researchers – a recognition of influential researchers from universities, research institutes and commercial organizations around the world who have demonstrated significant and broad impact in their respective fields of research.

Prof. Guichuan Xing, a professor of IAPME, has been named to the list, highlighting his remarkable contributions and influence in the Cross-Field category. For more information, please visit.

https://clarivate.com/highly-cited-researchers/?action=clv_hcr_members_filter&clv-paged=1&clv-category=&clv-institution=University%20of%20Macau&clv-region=&clv-name=



❖ IAPME attended the Guangdong Energy Industry Science and Technology Innovation and New Energy Storage Industry Quality Development Conference

On 22 November 2024, the Guangdong Energy Industry Science and Technology Innovation and New Energy Storage Industry Quality Development Conference was successfully held in Guangzhou. The conference was the first energy industry science and technology innovation event held in Guangdong Province and was jointly organized by China Southern Power Grid Company Limited, China Guangnan Nuclear Corporation Limited, China Energy Construction Group Company Limited, and Guangdong Energy Group Company Limited, with strong support from Guangdong Development and Reform Commission, Department of Science and Technology, Department of Industry and Information Technology, and the Bureau of Energy.

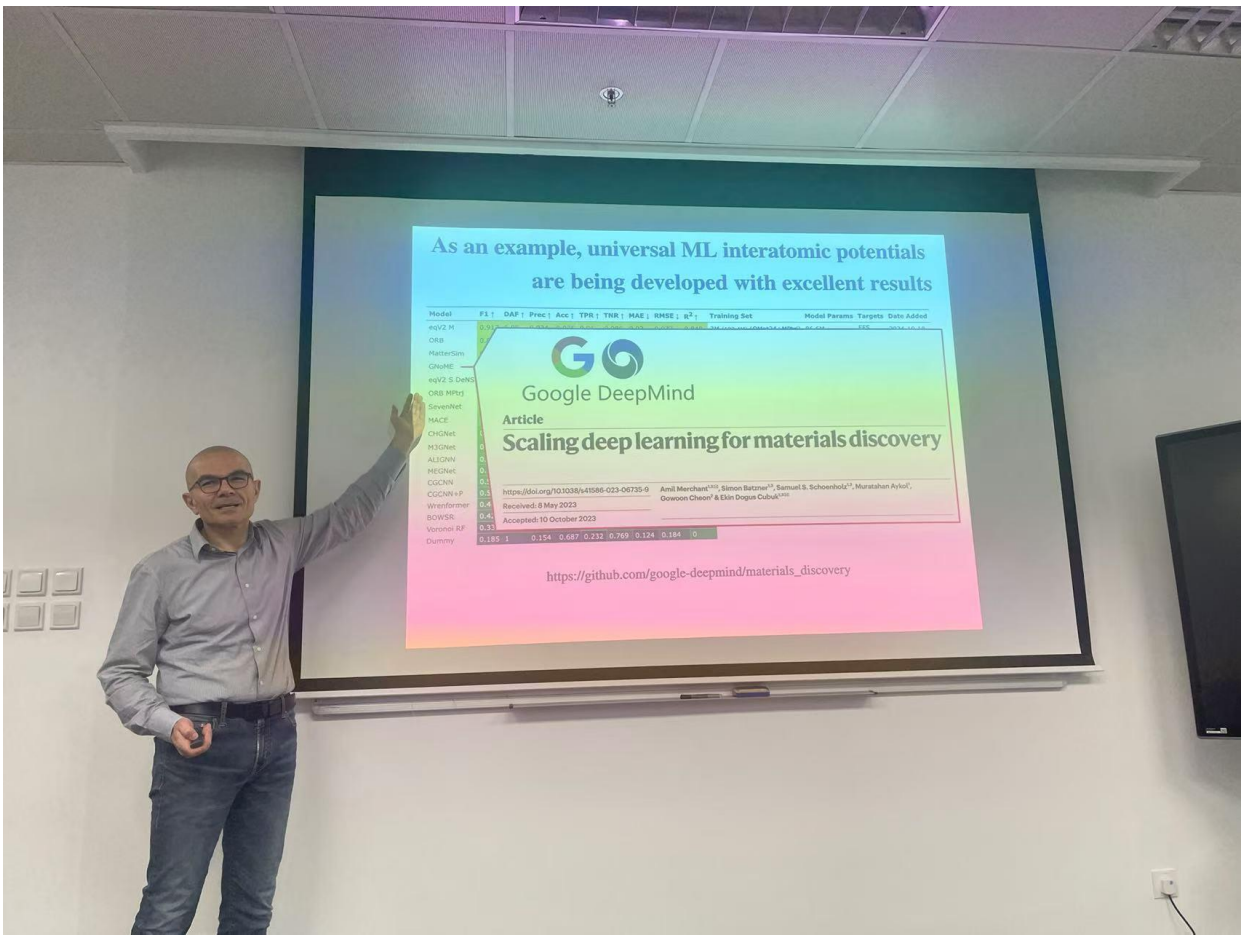
Prof. Shuangpeng Wang was invited to participate in this event and reached a project cooperation agreement with Guangdong Power Grid Co. Ltd on “Hengqin Digital Zero Carbon Island Shared Lab”.

❖ Seminars

Prof. Rignanese is a renowned scientist in the field of computational physics and has published more than 177 publications. He is also an APS Fellow for his original efforts developing free license software in the field of electronic structure calculations, and high-throughput calculations in a broad range of material types.

In his presentation, Prof. Rignanese introduced the databases that have also become available online from high-throughput calculations, providing access to various properties of materials, mainly ground state properties though ab initio calculations. This allows for the identification of many new compounds for a variety of applications (e.g., lithium battery and photovoltaic).

Prof. Rignanese also presented the strength and promising synergic effect of the combination of machine learning, database and simulations. Besides, a discussion between students from IAPME and Prof. Rignanese was held later in the afternoon on the same day



❖ Tenured Chair Professor Daping Chu and Renowned Soprano Prof. Miao Lu Visited IAPME

Invited by Prof. Wei Ge , Interim Director of IAPME, Prof. Handong Sun, Associate Director of IAPME, and Prof. Liu Yang, College Master of Ma Man Kei and Lo Pak Sam College, Prof. Daping Chu from the University of Cambridge, UK, and his wife, acclaimed soprano Prof. Miao Lu, visited IAPME on 25 November 2024.

Prof. Chu holds a bachelor's and master's degree in Physics from Nanjing University (1982, 1986) and began his career as an Assistant Researcher in the Theoretical Physics Group of the Institute of Physics, Chinese Academy of Sciences. He earned his PhD from the University of Warwick in 1998 and subsequently worked as a Senior Researcher in the Department of Engineering at the University of Cambridge. From 1999 to 2008, he served as a Chief Researcher and then Executive Researcher at Epson Cambridge Laboratory while also holding the position of Affiliate Lecturer at Cambridge.

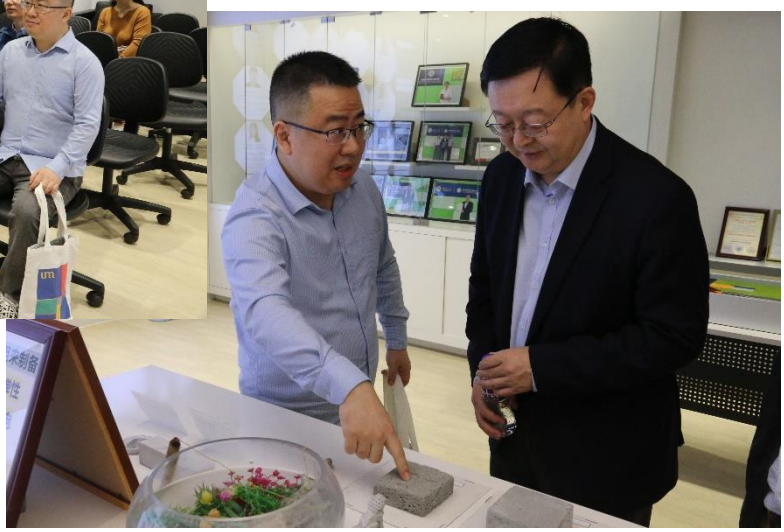
(From left) Prof. Guoxing Sun, Prof. Guichuan Xing, Prof. Liu Yang, Prof. Miao Lu, Prof. Daping Chu, Prof. Handong Sun, Prof. Hongchao Liu, and Prof. Haomin Song

Prof. Chu is a tenured Chair Professor of Technology and Innovation at the University of Cambridge and serves as the Director of the Centre for Advanced Photonics and Electronics (CAPE) and the Centre for Photoelectric Devices and Sensors (CPDS). He is also the Director of the Cambridge University-Nanjing Technology and Innovation Centre and a Fellow of Selwyn College, the Institute of Physics, and the Institution of Engineering and Technology.

His research interests include spatial light modulators and modulation technology, holographic technology, naked-eye 3D displays, head-mounted and head-up displays (HMDs and HUDs), all-optical network optical communication switches, digital lighting, flexible printed electronics, laminated high-brightness multi-stable reflective display devices and manufacturing. Prof. Chu has made remarkable contributions in these fields, earning a distinguished reputation in the international academic community.

(From left) Prof. Daping Chu and Prof. Handong Sun

During their visit, Prof. Handong Sun introduced the rapid development of UM and IAPME, while Prof. Guichuan Xing provided an overview of the dynamic and growing Department of Physics and Chemistry at the Faculty of Sciences and Technology. Prof. Chu commended IAPME for its remarkable progress and unique research achievements. Following the introductions, Prof. Guoxing Sun showcased his pioneering research and commercialization results in functionalized cement and foam materials. Prof. Chu was deeply impressed by the innovation and expressed strong interest in its potential applications.



In a subsequent meeting, Prof. Chu shared insights into the development of the University of Cambridge, and offered invaluable advices on managing relationships among the government, the university and researchers in the commercialization process. He and Prof. Lu also engaged in a cultural exchange with Prof. Ge, discussing the cultural landscapes of the UK and Macao. Prof. Ge emphasized Macao's openness to global collaboration, and Prof. Chu expressed interest in exploring future partnerships in both research and commercialization.

(From left) Prof. Guichuan Xing, Prof. Liu Yang, Prof. Wei Ge, Prof. Miao Lu, Prof. Daping Chu, Prof. Handong Sun, Prof. Guoxing Sun, Prof. Hongchao Liu, and Prof. Haomin Song

❖ Upcoming Events

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IAPME Seminar

Electrically-driven nano-light sources based on tunnel junctions

11 December 2024

Prof. Tao WANG
Soochow University
Venue: N23-4018
Time: 15:00 - 16:00
Hosted by: Prof. Shen LAI

Abstract

Photonic circuits, utilizing photons as information carriers, present remarkable benefits such as high bandwidth and low energy dissipation in comparison with their electronic counterparts. However, photonic circuits generally possess a considerably larger footprint, thus restricting their prospects for achieving high-density integration. In this context, plasmonic circuits, with the capability of guiding photons at sub-diffractional dimensions, could serve as an alternative to photonic circuits, particularly on the micro- or nano-scale. In this talk, progresses in Wang group will be discussed regarding the electrically-driven nano-light sources for plasmonic circuits.

Biography

Prof. Tao WANG is currently a full professor at the Institute of Functional Nano & Soft Materials of Soochow University. He received his bachelor degree from Beijing University of Posts and Telecommunications in 2007 and Ph.D. from Paris-sud University in 2012. From 2012 to 2019, He was engaged in postdoctoral research at RWTH Aachen in Germany, National University of Singapore, and A*STAR in Singapore. In May 2019, he joined the Institute of Functional Nano and Soft Materials of Soochow University. Over the past years, he has mainly worked on electrically-driven nano-light sources. So far, he has published 40 papers as the first or corresponding author, including Nature Photonics (2), Nature Communications (1), Nano Letters (4), Advanced Materials (1), Advanced Science (1), Small (3) etc., and has been granted 5 patents.

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❖ Upcoming Events

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IAPME Seminar

Topological singularities under artificial gauge fields in metamaterials

12 December 2024

Prof. Shuang ZHANG
University of Hong Kong
Venue: N23-4018
Time: 10:30 - 11:30
Hosted by: Prof. Hongchao LIU

Abstract

Band singularities in periodic systems play a crucial role in determining their topological properties. Notable examples include Weyl points in three-dimensional systems and Yang monopoles in five-dimensional systems. When a magnetic field is applied to these systems, intriguing topological effects, such as chiral zero modes, emerge. These chiral zero modes are unidirectional propagating modes within the bulk. In this talk, I will demonstrate various topological singularities, including Weyl points, Dirac points, Yang monopoles, and Berry dipoles, using metamaterials. I will particularly focus on their interactions with artificially engineered gauge fields, facilitated by the flexibility in designing metamaterial properties.

Biography

Prof. Shuang ZHANG is a Chair Professor and Interim Head of the Department of Physics at the University of Hong Kong. He obtained his PhD in Electrical Engineering from the University of New Mexico. Thereafter, he worked as postdoc at UIUC and UC Berkeley. He joined the University of Birmingham, UK as a Reader in 2010 and was promoted to Professor in 2013. Prof. Zhang joined the University of Hong Kong as a Chair Professor in 2020. He was the recipient of IUPAP Young Scientist Award in Optics (2010), ERC consolidator grant (2015-2020), Royal Society Wolfson Research Award (2016-2021), and New Cornerstone Investigator program (2023-2028). He was elected OSA fellow in 2016, APS fellow in 2022, and has been on the list of highly cited researchers (by Clarviate) since 2018.

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❖ Upcoming Events

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IAPME Seminar

Dynamic Active Sites in Water Splitting

17 December 2024

Prof. Huanyu JIN
Shenzhen Institute of Advanced Technology, CAS
Venue: N23-4018
Time: 10:00 - 11:00
Hosted by: Prof. Kwun Nam HUI

Abstract

In-depth understanding of the real-time behaviors of active sites during electrocatalysis is essential for the advancement of sustainable energy conversion. Recently, the concept of dynamic active sites has been recognized as a potent approach for creating self-adaptive electrocatalysts that can address a variety of electrocatalytic reactions, outperforming traditional electrocatalysts with static active sites. Nonetheless, the comprehension of the underlying principles that guide the engineering of dynamic active sites is presently insufficient. In this work, we systematically analyze the fundamentals of dynamic active sites for water splitting and consider important future directions for this emerging field. We reveal that dynamic behaviors and reversibility are two crucial factors that influence electrocatalytic performance. By theoretical calculations and in-situ/ex-situ experiments, we demonstrated that dynamic active sites are stable in harsh conditions such as in acidic water oxidation, which pave the way to the development of the next-generation electrocatalyst.

Biography

Prof. Huanyu JIN is a full professor at the Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences (CAS). Before joining CAS, he served as a lecturer at the Institute for Sustainability, Energy, and Resources at the University of Adelaide. His research is dedicated to the development of innovative nanomaterials for sustainable chemical production, water splitting, and various other applications in energy conversion and utilization. He has published over 60 papers in renowned international academic journals, over 30 as the first/corresponding author, in journals such as Chem. Rev., Sci. Adv., Nat. Commun., Adv. Mater., and Angew. Chem. He has garnered 10,000 total citations and an H-index of 41. He has received awards such as the Stephen Wilkins Medal and the JMCA Emerging Investigator. He serves as an editorial board member for the journal 2D Materials and as a young editorial board member for journals such as InfoMat, Journal of Energy Chemistry, and Carbon Energy. He is listed as Highly Cited Researcher and "Stanford/Elsevier's Top 2% Scientist".

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❖ Upcoming Events

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IAPME Seminar

Light is beyond a journal

18 December 2024
Dr. Ying ZHANG
Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences
Venue: N23-4018
Time: 10:00 – 11:00
Hosted by: Prof. Songnan QU

Abstract
Light: Science & Applications, co-published by Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP), Chinese Academy of Sciences (CAS) and Springer Nature, is a peer-reviewed open access journal publishing high-quality articles in all areas of optics and photonics, including basic, applied, scientific and engineering results. With the latest impact factor of 20.6. Light has consistently ranked among the top three optical journals over the past decade. We view Light as primarily a journal, but we also consider it beyond its role as a journal. Firstly, this talk will introduce the basic situation, publishing practices, and brand development strategy of the Light-brand journal cluster, which is led by the world-class journal Light: Science & Applications, supported by the Light sister journals, and backed by high-quality Chinese journals. The talk concludes with sharing how to write high quality manuscript and improve the acceptance of submission, focusing on the submission strategy for the world-class journal Light: Science & Applications.

Biography
Dr. Ying ZHANG is the Director of Light Publishing Group at Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP), Chinese Academy of Sciences (CAS). He was a visiting scholar at the Institute of Optics, University of Rochester during 2017–2018. He currently serves as the executive editor-in-chief of Chinese Journal of Liquid Crystals and Displays as well as scientific editor of Light: Science & Applications. He was elected as young talents of China Science and Technology Journal Excellence Action Plan, outstanding talents in the field of journal publishing by Chinese Academy of Sciences, high-level talents of Jilin Province. He won the first prize and outstanding contribution award of project supported by STM Journal Society, CAS. He has hosted and participated in more than 10 provincial and ministerial projects of China. He has published over 40 SCI/EI and management papers. He has also presented over 50 invited talks and has been interviewed by China's mainstream media. He participated in organizing and editing Handbook of Laser Technology and Applications (2nd Ed.) published by CRC, Taylor & Francis Group, as well as collection "Publishing Ethics of STM Periodicals" organized by China Association for Science and Technology.

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